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Mini Review

Risky Things that Happen When you Skip a Meal!

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Abstract

Dietary habits play an important role in the sustenance of good health, and prevention of lifestyle-associated health disorders like obesity, diabetes, dyslipidemia and hypertension. It is well established that the quantity and quality of the food we consume can affect our health. Now it is becoming clear that when we eat also plays a key role in health and disease [1]. May it be time constraint or weighty concern; meal skipping is growing enormous with almost 83% of the young population falling its prey [2]! This health-hazardous habit can impact the quality of life by predisposing us to various diseases in the future, such as a 55% increased risk for type 2 diabetes and a 75% increased risk for obesity.

Keywords: Obesity; Fasting; Sleep

Why is meal skipping hazardous to health?

Circadian clocks are a biological timing system found in virtually every cell of the body that coordinate the timing of our daily behaviors (e.g., sleep/wake, feeding/fasting). A consistent daily cycle of eating during the day and fasting during the night may nurture a healthy circadian clock and optimize metabolism by ascertaining a good appetite. The master circadian clock of our body is located in the hypothalamus of our brain (the suprachiasmatic nucleus SCN) and is responsible for orchestrating peripheral clocks in other organs. The circadian clock comprises of vital genes (such as CLOCK/circadian locomotor output cycles protein kaput, BMAL1/brain and muscle Arnt-like protein 1, PER/period, CRY/cryptochrome genes) which regulate our meal pattern and also the way our body uses nutrients like glucose, fat and protein. Meal skipping can negatively impact the regulation of these CLOCK genes resulting in obesity, diabetes and abnormal cholesterol levels. This is a strong point that notifies how even favorable genes can pose health hazards if accompanies by a faulty lifestyle. Another interesting fact is that, unfavorable expressions in the circadian CLOCK genes increase the innate tendencies to delay or skip a meal. Thus, to correct a faulty eating habit, the root cause or its trigger should be identified. And having known that such triggers can arise from innate tendencies, it is important to understand our genetic make-up [3,4].

Skipping meals increases blood glucose – how?

Researchers found that skipping meals during the day and eating one large meal in the evening resulted in potentially risky metabolic changes. The meal skippers had elevated fasting glucose levels and a delayed insulin response; if both these conditions persist for a long term, they can potentially lead to diabetes. Eating at consistent times is important for a healthy circadian rhythm [5,6].

Does late dinner/late night eating increases blood sugar?

- A scientific study in adults found that late-night eating increases blood sugar levels after the meal and the following day.

- Melatonin (a hormone released at night) reduces insulin release; the body is not able to process glucose properly when you eat late at night or very early in the morning, when melatonin is high. Therefore, eating larger meals earlier in the day and avoiding food for a few hours prior to bedtime may have health benefits.

- Observational studies in people have also found that late-night eating, irregular eating patterns, and poor food quality (i.e., increased snacking on high fat/high sugar foods and reduced fruit and vegetable consumption) are associated with obesity and greater risk of poor heart health [1].

Breakfast skipping increases blood sugar – why?

- Regular breakfast habits can keep us energetic in work and study. In addition, eating breakfast can increase satiety, thereby reducing overeating later in the day to restrict weight gain.

- Breakfast skipping is associated with a significantly increased risk of type 2 diabetes. In a large-scale scientific research (meta-analysis), the risk of type 2 diabetes increased with every additional day of breakfast skipping. And when breakfast was skipped for four to five days in a week, the risk for type 2 diabetes increased up to 55%. Hence, regular breakfast consumption is potentially important for the prevention of type 2 diabetes [7-9].

- Skipping breakfast may also hike triglyceride levels in blood and lead to an increase in glycated hemoglobin after lunch and dinner. These cumulative effects lead to impaired insulin response and increase the risk of type 2 diabetes [10].

- Body weight and sugar have a risky connection! Irregular breakfast can significantly decrease satiety, thus leading people to eat more at lunch, which will further increase the production of hunger-related hormones that are associated with higher glucose responses and obesity. Scientific evidence states an estimated 11% increased risk for overweight/obesity when breakfast is skipped on ≥3 days per week compared to ≤2 days per week. Compared to those who ate breakfast every day, breakfast skippers (ate breakfast only ≤3 days per week) showed a 75% increased risk of obesity. People who skipped breakfast gained approximately 1.5 kg weight over a period of 5 years compared to those who ate breakfast regularly; noteworthy is the fact that this weight gain solely arose from breakfast skipping [11,12].

- Skipping breakfast can make your heart skip a beat! Beware! Irregular breakfast habits might have an unhealthy impact on blood cholesterol levels, and it might also cause blood pressure hike in the morning (by negatively affecting the regulation of hypothalamic-pituitary-adrenal axis on blood pressure) [12,13].

Don't be a couch potato! As prolonged television watching and meal skipping double your diabetes risk!

- Risk of type 2 diabetes is positively associated with prolonged TV watching and breakfast skipping
- Watching more than 4 hours of television and video per day increases the risk of developing T2D. Probably because, TV watching is always related to higher energy intake than expenditure and leads to higher Body Mass Index/BMI, which affects metabolism by releasing unfavourable components like non-esterified fatty acids (NEFAs). These components at increased levels can lead to inadequate insulin secretion and insulin resistance (low insulin sensitivity), together contributing to the development of type 2 diabetes
- The average time spent watching TV is significantly associated with elevated levels of bad/ LDL cholesterol and lower levels of heart-healthy/HDL cholesterol [10].

Interesting facts on how to correct our lifestyle with the help of our genes!

All of us are aware that diet and physical activity occupy equal shares in weight control. There has to be a balance between the amount of calories we eat and the amount of energy we expend through physical activities like exercise. The extra calories that aren't expended for physical activities get stored up as fat and contribute to weight gain. Abnormal eating attitudes (innate tendencies to snack often or to eat huge meal portion size) can be due to faulty genes. Similarly there can be innate tendencies to lack motivation in moving around and being physically active. Motivation is the desire that drives us to maintain or achieve goals. Motivation for exercise comes from within through our brain's signals (neurotransmitters) that control reward-motivated behavior. In some people the motivation to engage in exercise because of the inherent satisfaction of the activity falls short due to

unfavorable genetic changes. This in turn can affect the adequacy of exercise, in terms of duration and frequency. Thus an insight on such genetic changes can help in coping them with right nutrition, thus paving way for exercise regularity.

The common meal pattern that we usually follow includes three main meals, which is breakfast, lunch and dinner. Snacking is a pattern of eating food in between the three main meals. Munching on something during mid-morning and evening is considered healthy, provided we make right choices. Snacking on options like sugar-sweetened beverages, fried snacks or fast foods for three or more times in a day can add extra calories and contribute to excess weight gain. Some people have a tendency to over snack, and this has a strong link with unfavorable genetic changes (in genes including leptin and melanocortin 4 receptor/ MC4R). Hence, it is important to understand such unfavorable genetic changes in order to adapt healthy snacking practices and stay in normal weight. Oversnacking is a tendency that develops because of an imbalance in our body's leptin levels caused by single nucleotide polymorphisms in the LEP gene. For instance, 'A' allele carriers of rs7799039 have low leptin levels and show extreme snacking pattern. A nutrigenetic recommendation of omega 3 fatty acids favorably regulates their leptin levels, promoting a healthy snacking pattern [14].

Exercise is a physical activity that we plan for a stipulated time and repeat based on our convenience. It is a bodily movement that makes us spend energy and benefits us with health betterment. Regularity of exercise demands motivation from within and motivation is the desire that drives us to maintain or achieve goals. Motivation for exercise comes from within through our brain's signals (neurotransmitters) that control reward-motivated behavior. In some people the motivation to engage in exercise because of the inherent satisfaction of the activity falls short due to unfavorable genetic changes. This in turn can affect the adequacy of exercise, in terms of duration and frequency. Thus an insight on such genetic changes can help in coping them with right nutrition, thus paving way for exercise regularity. For instance, dopamine, a neurotransmitter belonging to the catechol amine family has a role in motor control, motivation, arousal, cognition, and reward-motivated behaviour. The enzyme catechol-O-methyltransferase degrades catecholamines such as dopamine and is encoded by the COMT gene. A single nucleotide polymorphism in this gene rs4680, reduces dopamine signaling in its G allele carriers. Resulting in a poor inclination towards physical activity. Foods containing the amino acids phenylalanine and tyrosine are needed to improve motivation for regular exercise through improved dopamine signaling [15,16].

What is the 'cost of inactivity'? The answer is "those who think they have no time for exercise will sooner or later have to prepare themselves to find time for illness". Sedentary activities like TV watching are a type of recreation in limited amounts. But excessive indulgence in such activities replaces the scope of physical activity. Following is an example of how enormous TV watching induces a signaling pathway linked to cellular senescence and consequent diabetes risk. The HMGA2 gene encodes a protein belonging to the non-histone chromosomal high-mobility group (HMG) protein family which contains structural DNA-binding domains to act as a transcriptional regulating factor. Significantly higher expression of HMGA2 mRNA in white adipose tissue has been reported in people with type 2 diabetes/T2D. Increased HMGA2 expression can lead to increased expression of p14Arf, an inducer of cellular senescence. Accumulated senescent cells trigger inflammation associated with insulin resistance. And insulin resistance leads to type 2 diabetes. Sedentary activities like TV watching lower calorie expenditure, and induce signaling pathways (such as p14Arf) linked to cellular senescence. Single nucleotide polymorphisms such as rs2258238, rs10400419 in HMGA2 gene can cause insulin resistance, especially amongst prolonged TV watchers [10].

A protein-coding gene, CFL1, encodes cofilin-1 (an intracellular actin regulatory protein), which vitally regulates the organization of the actin cytoskeleton. Phosphorylated (inactive) cofilin-1 is upregulated in diabetic glomeruli, suggesting alterations in actin dynamics. CFL1 gene controls cell proliferation and cell death. Single nucleotide polymorphisms such as rs78028320 overexpress CFL1 in the subcutaneous adipose tissue of subjects who have gained weight, suggesting that the CFL1 gene affects the risk of type 2 diabetes through a mediating pathway of BMI (body mass index) [10]. 10 minutes of walking after each meal can lower blood sugar levels by 12%, as the need for additional insulin to control blood sugar is brought down by exercise [17].

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